


<b>Title of the Grant</b>	Polar Plasma Wave Investigation Data Analysis in the Extended Mission
<b>Type of Report</b>	Summary of Research
<b>Name of the Principal Investigator</b>	Donald A. Gurnett
<b>Period Covered by the Report</b>	April 1, 1999 through March 31, 2002
<b>Name and Address of the Recipient's Institution</b>	The University of Iowa Sponsored Programs 100 Gilmore Hall, Room 2 Iowa City, IA 52242
<b>Grant Number</b>	NAG5-7943
<b>Signature</b>	Prepared by:

  
Jolene S. Pickett  
Science Data Manager

  
Donald A. Gurnett  
Principal Investigator

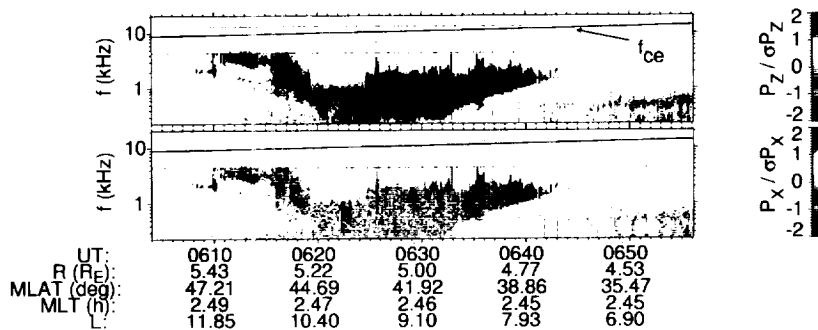
## SUMMARY OF RESEARCH

### 1.0 Purpose

This Summary of Research is being submitted to NASA Goddard Space Flight Center in fulfillment of the final reporting requirement under Grant NAG5-7943, which terminated on March 31, 2002. The following contains a summary of the significant accomplishments of the Polar Plasma Wave Investigation (PWI) team during the period of the grant, April 1, 1999 through March 31, 2002, and a listing of all of the publications that resulted from work carried out under the grant. Also included below is a listing of the numerous public outreach activities that took place during the period of the grant in which the Polar mission and Polar PWI science were discussed.

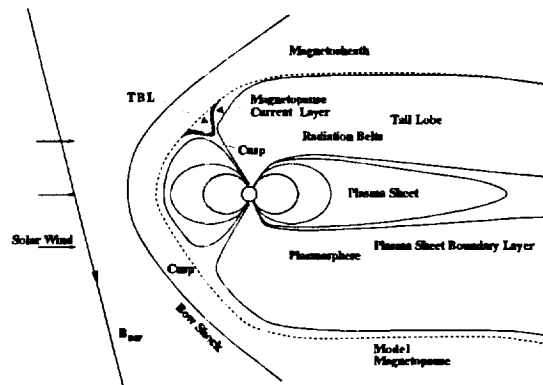
### 2.0 Summary of Significant Accomplishments

**Propagation of Auroral and Plasmaspheric Hiss:** Santolik and Gurnett [2002] have provided the first direct evidence of the propagation pattern of funnel-shaped auroral hiss at a radial distance of 5 Earth radii. They used multi-component wave measurements of Polar PWI, taking into account both electric and magnetic field fluctuations. Using sophisticated analysis techniques, they found that the waves propagate upward (Fig. 1, top) and the Poynting flux is directed toward higher latitudes in the high-latitude part of the emission and to lower latitudes in the low-latitude part (Fig. 1, bottom). The wave vectors are found to be close to the whistler mode resonance angle. Consistent with the theory, the latitudinal component of the wave vector is opposite compared to that of the Poynting flux in the low-latitude and high-latitude parts of the funnel-shaped emission. In the central part of the emission they found a very broad distribution of the wave energy with respect to the azimuth angle. The waves thus simultaneously come from different directions with different wave vectors. This is indicative of an extended sheet source region, rather than a vertical line or point source as has been previously suggested. The observed propagation pattern suggests that the sheet source is oriented roughly in the longitudinal direction, consistent with the region where we can expect the presence of upgoing or counterstreaming electron beams. Plasmaspheric hiss was also studied using these same techniques with the finding that waves with normals both parallel and anti-parallel to the magnetic field were being amplified by the classical mechanism of gyroresonance. The full results of that study can be found in Santolik et al. [2001].



**Fig. 1.** Components of the Poynting vector (top) parallel and (bottom) perpendicular to the DC magnetic field normalized by the standard deviations of their estimates. (Polar observations on March 6, 1997.)

**Plasma Waves Observed in the Cusp Turbulent Boundary Layer:** Pickett et al. [2001] performed an analysis of the high time resolution wave and particle measurements made by the Polar spacecraft in the cusp turbulent boundary layer (TBL), as shown in Fig. 2. This study was prompted, in part, by the opportunity to contribute to the Inter-Agency Consultative Group (IACG) for Space Sciences Campaign No. 2 on Boundaries in Collisionless Plasma. Because the boundary layers are quite turbulent, an abundance of bursty, electrostatic and electromagnetic waves and potential structures are found in them. Pickett et al. [2001] found that the cusp turbulent boundary layer located adjacent to the magnetopause almost always contains magnetic noise up to the electron cyclotron frequency, which was the subject of two papers [Pickett et al., 1999b; Pickett et al., 2002]. Pickett et al. [2001] also found that this boundary layer contains sinusoidal bursts of whistler mode waves at several frequencies; bipolar pulses, interpreted as positive potential structures or electron holes; bursts of electron cyclotron harmonic waves; and broadband bursts of electrostatic waves up to almost the plasma frequency occurring in packets modulated at the frequency of the hundreds of Hz whistler mode waves. High time resolution Hydra data was consistent with a conclusion that the parallel electric field of the hundreds of Hz whistler mode waves traps electrons around 30 eV, which leads to the generation of the broadband bursts of electrostatic waves through a resistive medium instability. The whistler modes waves were most likely generated at the reconnection site closest to the spacecraft. The results of these studies are being used in various ongoing comprehensive boundary layer studies by the IACG-2 Campaign Study Group and in conjunction with ongoing Cluster studies of boundary layers.



**Fig. 2.** Bursty electrostatic and electromagnetic waves and potential structures are found in the turbulent boundary layer (TBL) located near the magnetopause current layer in the outer cusp.

**Statistical Study of AKR Fine Structure:** Menietti et al. [2000] conducted a statistical survey of a semi-random sample of the auroral kilometric radiation (AKR) data observed by the PWI Wideband Receiver on Polar. They determined that the AKR fine structure patterns with very narrowband, negative drifting striations occur in approximately 6% of the high-resolution wideband spectrograms when AKR is present. Positive sloping striations are also observed, but at a much lower rate. The stripes are predominantly found in the 40-215 kHz frequency range and have a frequency extent of about 4 kHz and duration of usually less than 2 seconds. The majority of the stripes have drift rates between -8 and -2 kHz/s. There is also a much smaller group of striations with positive drift rates of up to about 5 or 6 kHz/s. There is an increase in the statistical drift rate with increasing frequency and the statistical slope of the striations increases with frequency. This frequency dependence of the drift rate is consistent, under certain conditions, with a production mechanism stimulated by an upward propagating electromagnetic ion cyclotron wave, as has been previously suggested. However, such a changing drift rate is also compatible with a stimulated source region that propagates upward along the magnetic field

line at the velocity of an ion beam accelerated by a local, upward directed electric field as is typically observed in the auroral region. An exciting, alternative explanation could lie in solitary structures, or electron holes, recently discovered in FAST spacecraft data. These structures travel anti-earthward with velocities that are a significant fraction of the particle beam (between ~500 and ~5000 km/s). These velocities are of similar magnitude and direction as required to explain the AKR striation frequency drift rates. Ongoing collaborative studies with FAST investigators of this possibility are underway.

***Simultaneous Triggered VLF Emissions and Energetic Electron Distributions:*** Bell et al. [2000] reported simultaneous observations of energetic 1-20 keV electrons and VLF emissions triggered within the plasmasphere by pulses from ground based VLF transmitters, using the PWI and Hydra instrument on the Polar spacecraft. The VLF emissions are believed to be generated through a nonlinear phase trapping mechanism inherent to the cyclotron resonance interaction. Emissions are generated by the pulses only when the particle flux is enhanced well above background and the particle pitch angle distribution is very highly anisotropic, with the average equatorial pitch angle exceeding ~ 75 degrees. The particles are trapped typically within 7 degrees of the magnetic equator because of these high pitch angles. Only pulses that propagate within whistler mode ducts are observed to trigger emissions. The observed pitch angle anisotropies are much larger than those assumed in present models of the VLF emission -triggering phenomenon. Thus, these observations provide a new starting point for understanding the emission process.

### 3.0 Publications

#### 3.1 Statistics of Publications

During the period of this grant the Polar PWI team has been very active in disseminating their research results through written reports and publications. The following statistics detail how many and what kinds of publications have been completed during the 3 years of the grant:

	PWI Team Member First Author or PWI As Prime Data	PWI Team Member as a Contributing Author (Not First)
Published:		
Refereed Journal	17	13
Other (e.g. thesis)	6	0
In Press:		
Refereed Journal	6	2
Other	1	0
Submitted:		
Refereed Journal	1	1
Other	0	0

### 3.2 List of Publications during Reporting Period

A list of all of the publications that resulted from work carried out partially or wholly under the subject grant is as follows:

#### 1999

Fritz, T. A., J. Chen, R. B. Sheldon, H. E. Spence, J. F. Fennell, S. Livi, C. T. Russell, and J. S. Pickett, Cusp Energetic Particle Events Measured by Polar Spacecraft, *Phys. Chem. Earth*, 24, 135-140, 1999.

Imhof, W. L., R. R. Anderson, D. L. Chenette, J. Mobilia, S. M. Petrinec, and M. Walt, The Correlation of Rapid AKR Variations with Changes in the Fluxes of Precipitating Electrons, *Adv. Space Res.* 23, No. 10, 1747-1752, 1999.

Lakhina, G. S., and B. T. Tsurutani, Broadband Plasma Waves in the Magnetopause and Polar Cap Boundary Layers, *Surveys Geophys.*, 20, 377-414, 1999.

Lauben, D. S., U. S. Inan and T. F. Bell, Poleward-Displaced Electron Precipitation from Lightning-Generated Oblique Whistlers, *Geophys. Res. Lett.*, 26, 2633-2636, 1999.

Liou, K., C.-I. Meng, T. Y. Lui, P. T. Newell, M. Brittnacher, G. Parks, G. D. Reeves, R. R. Anderson, and K. Yumoto, On Relative Timing in Substorm Onset Signatures, *J. Geophys. Res.*, 104, 22,807-22,817, 1999.

Pickett, J. S., D. A. Gurnett, J. D. Menietti, M. J. LeDocq, J. D. Scudder, L. A. Frank, J. B. Sigwarth, K. L. Ackerson, D. D. Morgan, J. R. Franz, P. M. Kintner, B. T. Tsurutani, C. M. Ho, J. Chen, T. A. Fritz, C. T. Russell, W. K. Peterson, Y. Kasahara, I. Kimura, S. Watanabe, G. G. Arkos, G. Rostocker, S. Kokubun, H. Fukunishi, R. F. Pfaff, F. S. Mozer, S.-Y. Hsieh, T. Mukai, and M. O. Chandler, Plasma Waves Observed During Cusp Energetic Particle Events and Their Correlation With Polar and Akebono Satellite and Ground Data, *Adv. Space Res.*, 24, 23-33, 1999a.

Pickett, J. S., J. D. Menietti, J. H. Dowell, D. A. Gurnett, and J. D. Scudder, Polar spacecraft observations of the turbulent outer cusp/magnetopause boundary layer of Earth, *Nonlinear Processes in Geophysics*, 6, 195-204, Sept./Dec. 1999b.

Storey, L. R. O., The Measurement of Wave Distribution Functions, in *Modern Radio Science 1999*, ed. by M. A. Stuchly, Oxford University Press, 249-271, 1999.

#### 2000

Bell, T. F., U. S. Inan, R. A. Helliwell, and J. D. Scudder, Simultaneous Triggered VLF Emissions and Energetic Electron Distributions Observed on Polar with PWI and HYDRA, *Geophys. Res. Lett.*, 27, 165-168, 2000.

Franz, J. R., A Study of Electron Phase-Space Holes in the Polar Magnetosphere, Ph.D. Dissertation, Cornell University, January, 2000a.

Franz, J. R., P. M. Kintner, C. E. Seyler, J. S. Pickett, and J. D. Scudder, On the Perpendicular Scale of Electron Phase-Space Holes, *Geophys. Res. Lett.*, 27, 169-172, 2000b.

Huddleston, M. M., C. J. Pollock, M. P. Wuest, J. S. Pickett, T. E. Moore, and W. K. Peterson, Toroidal Ion Distributions Observed at High Altitudes Equatorward of the Cusp, *Geophys. Res. Lett.*, 27, 469-472, 2000.

Imhoff, W. L., M. Walt, R. R. Anderson, D. L. Chenette, J. D. Hawley, J. Mobilia, and S. M. Petrinec, Association of Electron Precipitation with Auroral Kilometric Radiation, *J. Geophys. Res.*, 105, 277-289, January 2000.

Kintner, P. M., P. W. Schuck, and J. R. Franz, Spaced Measurements and Progress in Understanding Space Plasma Waves, *Physics of Plasmas*, 5, 2135-2141, 2000.

Lakhina, G. S. Magnetospheric Phenomenon, in Indian Institute of Geomagnetism, Annual Report 1998-1999, pp. 6-9, 2000.

Lakhina, G. S., B. T. Tsurutani, H. Kojima, and H. Matsumoto, Broadband Plasma Waves in the Boundary Layers, *J. Geophys. Res.*, 105, 27,791-27,831, 2000a.

Lakhina, G. S., B. T. Tsurutani, J. K. Arballo, and C. Galvan, Sun-Earth Connection: Boundary Layer Waves and Auroras, *PRAMANA-J. Phys.*, 55, 665-683, 2000b.

Liou, K., C.-I. Meng, A. T. Y. Lui, P. T. Newell, and R. R. Anderson, Auroral Kilometric Radiation at Substorm Onset, *J. Geophys. Res.*, 105, 24,325, 2000.

Menietti, J. D., A. M. Persoon, J. S. Pickett, and D. A. Gurnett, Statistical Study of Auroral Kilometric Radiation Fine-Structure Striations Observed by Polar, *J. Geophys. Res.*, 105, 18,857-18,866, August 2000.

Tsurutani, B. T., Solar/Interplanetary Plasma Phenomena Causing Geomagnetic Activity at Earth, in *Proceedings of the International School of Physics "Enrico Fermi,"* ed. by B. Coppi, A. Ferrari, and E. Sindoni, IOS Press, Amsterdam, 2000.

## 2001

Cairns, I. H. and J. D. Menietti, Stochastic Growth of Waves over Earth's Polar Cap, *J. Geophys. Res.*, 106, 29,515-29,529, December 2001.

Chen, J., T. A. Fritz, R. B. Sheldon, J. S. Pickett, and C. T. Russell, The Discovery of a New Acceleration and Possible Trapping Region of the Magnetosphere, *Adv. Space Res.*, 27(8), 1417-1422, 2001.

Goldstein, J., R. E. Denton, M. K. Hudson, E. G. Miftakhova, D. L. Gallagher, and J. D. Menietti, Latitudinal Density Dependence of Magnetic Field Lines Inferred from Polar Plasma Wave Data, *J. Geophys. Res.*, 106, 6195-6201, 2001.

Imhof, W. M., M. Walt, R. R. Anderson, J. D. Hawley, M. J. Brittnacher, S. M. Petrinec, and H. Matsumoto, Relationship Between X-Ray, Ultraviolet, and Kilometric Radiation in the Auroral Region, *J. Geophys. Res.*, 106, 10,479-10,492, 2001.

Janhunen, P., A. Olsson, W. K. Peterson, H. Laakso, J. S. Pickett, T. I. Pulkkinen, and C. T. Russell, A Study of Inverted-V Auroral Acceleration Mechanisms Using Polar/Fast Conjunctions, *J. Geophys. Res.*, 106, 18,995-19,001, 2001.

Lauben, D. S., U. S. Inan, and T. F. Bell, Precipitation of Radiation Belt Electrons Induced by Obliquely-Propagating Lightning-Generated Whistlers, *J. Geophys. Res.*, 106, 29,745-29,770, 2001.

Menietti, J. D., J. S. Pickett, D. A. Gurnett, and J. D. Scudder, Electrostatic Electron Cyclotron Waves Observed by the Plasma Wave Instrument on Board Polar, *J. Geophys. Res.*, 106, 6043-6057, 2001.

Pickett, J. S., J. R. Franz, J. D. Scudder, J. D. Menietti, D. A. Gurnett, G. B. Hospodarsky, R. M. Braunger, P. M. Kintner, and W. S. Kurth, Plasma Waves Observed in the Cusp Turbulent Boundary Layer: An Analysis of High Time Resolution Wave and Particle Measurements from the Polar Spacecraft, *J. Geophys. Res.*, 106, 19,081-19,099, 2001.

Santolik, O., M. Parrot, L. R. O. Storey, J. Pickett, and D. A. Gurnett, Propagation Analysis of Plasmaspheric Hiss Using Polar PWI Measurements, *Geophys. Res. Lett.*, 28, 1127-1130, March 2001.

Stasiewicz, K., C. E. Seyler, F. Mozer, G. Gustafsson, J. Pickett, and B. Popielawska, Magnetic Bubbles and Kinetic Alfvén Waves in the High-Latitude Magnetopause Boundary, *J. Geophys. Res.*, 106, 29,503-29,514, 2001.

Tsurutani, B. T., X. Y. Zhou, J. K. Arballo, W. D. Gonzalez, G. S. Lakhina, V. Vasyliunas, J. S. Pickett, T. Araki, H. Yang, G. Rostoker, T. J. Hughes, R. P. Lepping, and D. Berdichevsky, Auroral Zone Dayside Precipitation During Magnetic Storm Initial Phases, *J. Atmos. Solar Terres. Phys.*, 63, 513-522, 2001a.

Tsurutani, B. T., J. K. Arballo, C. Galvan, L. D. Zhang, X.-Y. Zhou, G. S. Lakhina, T. Hada, W. D. Gonzalez, J. S. Pickett, and D. A. Gurnett, Polar Cap Boundary Layer Waves: An Auroral Zone Phenomenon, *J. Geophys. Res.*, 106, 19,035-19,055, 2001b.

Tsurutani, B. T., X.Y. Zhou, V. Vasyliunas, G. Haerendel, J. K. Arballo, and G. S. Lakhina, Interplanetary Shocks, Magnetopause Boundary Layers and Dayside Auroras, *Surveys Geophys.*, 22, 101-130, 2001c.

Tsurutani, B. T., J. K. Arballo, C. Galvan, L. D. Zhang, G. S. Lakhina, T. Hada, J. S. Pickett, and D. A. Gurnett, Auroral Zone Plasma Waves Detected at Polar: PCBL Waves, *Adv. Space Res.*, 28(11), 1655-1659, 2001d.

## 2002

Grabbe, C. L. and J. D. Menietti, Electrostatic Wave Variety and the Origins of BEN, *Planet. Space Sci.*, 50, 335-341, 2002.

Lakhina, G. S., and B. T. Tsurutani, Plasma Waves in the Low-Latitude Boundary Layer, Adv. Contemporary Physics and Energy, eds. C. S. Kaushik, G. N. Tiwari, V. K. Tripathi, I. C. Goyal, and A. Chandra, Allied Publishers Pvt. Ltd., New Delhi, pp. 166-185, 2002.

### ***Publications - In Press***

Denton, R. R., J. Goldstein, J. D. Menietti, and S. L. Young, Magnetospheric Electron Density Model Inferred from Polar Plasma Wave Data, J. Geophys. Res., in press, 2002.

Lakhina, G., B. T. Tsurutani, and J. S. Pickett, Broadband Plasma Waves in the Magnetopause and Plasma Sheet Boundary Layer, Radio Science, in press, 2002.

Menietti, J. D., O. Santolik, J. D. Scudder, J. S. Pickett, and D. A. Gurnett, Electrostatic Electron Cyclotron Waves Generated by Low Energy Electron Beams, J. Geophys. Res., in press, 2002.

Pickett, J. S., J. D. Menietti, G. B. Hospodarsky, D. A. Gurnett, and K. Stasiewicz, Analysis of the Turbulence Observed in the Outer Cusp Turbulent Boundary Layer, Adv. Space Res., in press, 2002.

Santolik, O. and D. A. Gurnett, Propagation of Auroral Hiss at High Altitudes, Geophys. Res. Lett., in press, 2002.

Santolik, O., J. S. Pickett, and D. A. Gurnett, Electromagnetic Auroral Waves Near the Proton Gyrofrequency and its Lowest Harmonics, J. Geophys. Res., in press, 2002.

Tsurutani, B. T., The Role of Waves in Substorm Onsets, Phys. Chem. Earth, in press, 2001.

Tsurutani, B. T., G. S. Lakhina, J. S. Pickett, and Y. Kasahara, ELF/VLF Plasma Waves in the Low Latitude Boundary Layer, *Proceedings of the Chapman Conference on Boundary Layers*, April, 2001, New Orleans, LA, in press, 2002.

Walt, M., H. D. Voss, and J. Pickett, Electron Precipitation Coincident with ELF/VLF Wave Bursts, J. Geophys. Res., in press, 2002.

### ***Publications - Submitted***

Savin, S., L. Zelenyi, S. Romanov, I. Sandahl, J. Pickett, and 30 other authors, Magnetosheath-Cusp Interface, *Annales Geophysicae*, submitted, 2001.

Tsurutani, B. T., B. Dasgupta, J. K. Arballo, G. S. Lakhina, J. S. Pickett, Magnetic Holes, Ion and Electron Heating, and the Onsets of Bipolar Pulse (Electron Hole) Events: A Unifying Scenario, Nonlinear Processes in Geophysics, submitted, 2001.

## **4.0 Public Outreach**

A list of the public outreach activities carried out during the term of the subject grant in which the Polar mission and Polar PWI science were discussed is as follows:



## **1999**

Iowa Space Pioneers Exhibit, Located in Old Capital Mall, Iowa City, Iowa; July 20, 1998 - May 31, 1999. Display showcased the leading role the University of Iowa played in the exploration of space. The exhibit included satellites, scientific instruments, past and present project information, photo gallery, and hands-on activities. Exhibit information and photos

Northwest Junior High Extended Learning Program, George Hospodarsky, Coralville, Iowa, April 6, 1999. Discussed careers in space physics and University of Iowa's role in past and present space research projects.

Northwest Junior High Extended Learning Program, George Hospodarsky, Iowa City, Iowa, April 9, 1999. Provided a guided tour of the University of Iowa space physics laboratory areas, a discussion of the University's involvement in past and present projects, and methods of handling data retrieval and analysis.

Coralville Central Elementary Kindergarden Class, William Kurth, Coralville, Iowa, April 15, 1999. Overview of space, our solar system, and information gathered by spaceflight hardware.

Space: Past, Present, and Future, Located at the Science Station, Cedar Rapids, Iowa, July 17, 1999 - December 31, 1999. Traveling exhibit that includes the Iowa Space Pioneers Exhibit (prepared by U. of Iowa Physics and Astronomy staff and U. of Iowa Graphics Service Staff). Exhibit information and photos

Sounds of Space Web Page, prepared by Larry Granroth and Joseph Groene. Currently includes sounds of the magnetosphere that were produced by processing Polar Plasma Wave data into audible sounds. Location: <http://listen.to/space-audio>.

## **2000**

Space: Past, Present, and Future, Located at the Science Center of Iowa, Des Moines, Iowa, January 15, 2000 through June 2000. Traveling exhibit that includes the Iowa Space Pioneers Exhibit (prepared by U. of Iowa Physics and Astronomy staff and U. of Iowa Graphics Service Staff). Exhibit information and photos

Space Physics Research, George Hospodarsky, Northwest Jr. High School Coralville, Iowa, March 24, 2000. Discussed University of Iowa's participation in the Voyager, Galileo, Polar, and Cassini missions.

Space Physics Research, George Hospodarsky, 2nd and 3rd Grade classes, Solon, Iowa, April 19, 2000. Discussed space, space physics, and the Cassini and Polar missions.

Radio and Plasma Wave Phenomena Recorded by Voyager, Galileo, and Polar, William S. Kurth, Regina Science Club (high school), Iowa City, Iowa, May 9, 2000. Provided Polar, Voyager, and Galileo radio and plasma wave phenomena audio .wav files for the Regina Science Club's Image Media Experiment that is part of the NASA Student Involvement Program (NSIP). The experiment will send images and sounds on various media into space on the space shuttle to determine the effects of the space

environment on the media.

Summary of Physics, Astronomy, and Engineering Efforts Required to Successfully Complete Experimental Space Physics Projects, George B. Hospodarsky, Prospective Undergraduate Student Tour, Dept. of Physics and Astronomy, University of Iowa, Iowa City, Iowa, May 12, 2000.

Public Library Summer Reading Program "Cosmic Connections," Coralville and Iowa City, Iowa, June - September 2000. The University of Iowa and the Jet Propulsion Laboratory provided Voyager, Galileo, Cassini, and Polar project-related posters, bookmarks, photos, postcards, and coloring books to be used as rewards for students participating in library events during the summer.

The Iowa Space Pioneers, Located at the Bluedorn Science Imaginarium, Waterloo, Iowa, June 20, 2000 - October 20, 2000. Traveling exhibit that includes the Iowa Space Pioneers Exhibit (prepared by U. of Iowa Physics and Astronomy staff and U. of Iowa Graphics Service Staff). Exhibit information and photos

Weber Elementary English as a Second Language Class, (10 students), George Hospodarsky led a laboratory tour and discussion about building space instrumentation, Iowa City, Iowa, December 18, 2000. Polar, Cluster, and Cassini projects were discussed.

## **2001**

Space: Past, Present, Future - The Iowa Space Pioneers, Sanford Museum and Planetarium, Cherokee, Iowa, January 4, 2001 - June, 2001. Exhibit information and photos

Aurora/2001: Dance of the Auroras, Fire in the Sky, Maida Withers Dance Construction Co., Lisner Auditorium, Washington, DC, February 15-16, 2001. Included in the music of this performance are sounds from the recordings collected by the Polar plasma wave investigation.

Life of a Space Scientist at the University of Iowa, George Hospodarsky, Solon Elementary School (Grades 3 & 4), Solon, Iowa, April 26, 2001. (Galileo, Polar, Cassini, Cluster)

Life as a Space Scientist, George Hospodarsky, Northwest Jr. High School, Coralville, Iowa. May 10, 2001. (Galileo, Polar, Cassini, Cluster)

Tour of U. of Iowa Space Physics Laboratories, George Hospodarsky, Northwest Jr. High School students, Iowa City, Iowa, May 22, 2001. (Voyager, Galileo, Polar, Cassini, Cluster, Mars Express)

Overview of University of Iowa Space Research and Life as a Scientist, George Hospodarsky, at the Dept. of Physics and Astronomy, University of Iowa, Iowa City, Iowa, July 25, 2001. (Polar, Cassini, Galileo, Cluster)

Summary of U. of Iowa's Participation in Experimental Space Physics, George Hospodarsky, Korean Teacher's Workshop, University of Iowa, Iowa City, Iowa, August 17, 2001.

Space Physics Display: Summary of University of Iowa Space Physics Projects, Fly Iowa 2001, Iowa City, Iowa, August 25-26, 2001.